

# A Standard Protocol for Evaluating the Performance of Anaerobic Digestion Systems Used by Livestock Producers

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# Support

- The Association of State Energy Research and Technology Transfer Institutions (ASERTTI)
- The U.S. Environmental Agency's AgSTAR Program

# Purpose

To provide a standard for evaluating and reporting the performance of manurial biogas systems and including reports in a national database such as the ASERTTI distributed generation performance database.

# Structure of the Protocol

- Prerequisites for performance evaluations
- Specification of required background information
- Requirements for characterizing performance with respect to:
  - Waste stabilization
  - Biogas production and utilization
- Standards for economic analysis

# Prerequisites for Performance Evaluations

- Full-scale systems located on commercial livestock operations
- A minimum of 12-months in duration
- Steady-state conditions after completion of start-up

# Required Background Information

- Name, location, and type of operation
- Type, age and number of animals
- Type of manure handling system
- Type of digester and design details
- Type of biogas utilization system with design details
- Source(s) of revenue from biogas production

# Waste Stabilization

- Parameters:
  - Minimum: TS, TVS, COD, TP, and pH
  - Optional: TVA, TKN, ON,  $\text{NH}_4\text{-N}$ , indicator organisms, pathogens
- Sample collection: representative composites of 24-hour flows
- Frequency of sample collection: monthly or semi-monthly?
- Sample preservation and analytical methods

# Biogas Production & Utilization

- Measuring production: total and utilized
- Biogas composition:  $\text{CH}_4$ ,  $\text{CO}_2$ ,  $\text{H}_2\text{S}$ , and  $\text{NH}_3$
- Utilization:
  - Generating electricity: kWh generated, thermal conversion efficiency, and waste heat recovered and utilized
  - Boiler fuel: Conventional fuel Btu replaced
- Reporting standards: The per animal day problem with co-digestion



# Economic Analysis—Costs

- General approach: an independent enterprise
- Boundary conditions: exclusions and inclusions
- Annual capital cost: cannot exclude recovery with interest of an owner's investment
- Annual operating and maintenance costs: a better basis for estimation is needed

# Economic Analysis—Revenue

- Valuing on-farm energy use: rate structure differences and demand charge impacts need to be included
- Revenue from by-products: what is valid and what is not

Thank-you

Questions?